What is claimed is:

1. A nitride-based compound semiconductor electron device comprising:

a substrate; and

a semiconductor layer structure including a buffer layer structure, a channel layer and a donor layer, that are consecutively formed in this order on said substrate,

wherein said buffer layer structure includes: at least one first buffer layer comprising as a main component thereof a compound semiconductor expressed by the general formula of $Al_xIn_yGa_{1-x-y}As_uP_vN_{1-u-v}$ (where $0 \leq x \leq 1$, $0 \leq y \leq 1$, $x+y \leq 1$, $0 \leq u < 1$, $0 \leq v < 1$, and $u+v<1$); and at least one second buffer layer comprising as a main component thereof a compound semiconductor expressed by the general formula of $Al_aIn_bGa_{1-a-b}As_cP_dN_{1-c-d}$ (where $0 \leq a \leq 1$, $0 \leq b \leq 1$, $a+b \leq 1$, $0 \leq c < 1$, $0 \leq d < 1$, and $c+d<1$), and wherein said first buffer layer and said second buffer layer have different bandgap energies, and have two-dimensional electron gas density or densities therein not greater than 5×10^{12} cm^{-2}.

2. The semiconductor electron device according to claim 1, wherein said first buffer layer has a thickness of not less than 0.5 nm and not greater than 20 nm, and said second buffer layer has a thickness of not less than 0.5 nm and not greater than 20 nm.

3. The semiconductor electron device according to claim 2, wherein said second buffer layer has a bandgap energy greater than a bandgap energy of said first buffer layer and has an Al composition not less than 0.5 and a thickness not less than 1 nm and nor greater than 10 nm.

4. The semiconductor electron device according to claim 2, wherein said first and second buffer layers comprise one of Mg, Be, Zn, and C in an amount of not less than 1×10^{16} cm^{-3} and not greater than 1×10^{21} cm^{-3}.

5. The semiconductor electron device according to claim 2, having an operating current of not less than 1 ampere or an operating voltage of not less than 100 volts.

6. The semiconductor electron device according to claim 1, wherein said buffer layer structure includes a plurality of said first buffer layers and a plurality of said second buffer layers, which are alternately laid one on another.

7. The semiconductor electron device according to claim 6, wherein each of said first buffer layers has a thickness of not less than 0.5 nm and not greater than 20 nm, and each of said second buffer layers has a thickness of not less than 0.5 nm and

not greater than 20 nm.

8. The semiconductor electron device according to claim 6, wherein each of said second buffer layers has a bandgap energy greater than a bandgap energy of each of said first buffer layer and has an Al composition not less than 0.5 and a thickness not less than 1 nm and nor greater than 10 nm.

9. The semiconductor electron device according to claim 6, wherein each of said first and second buffer layers comprises one of Mg, Be, Zn and C in an amount of not less than 1×10^{16} cm^{-3} and not greater than 1×10^{21} cm^{-3}.

10. The semiconductor electron device according to claim 6, having an operating current of not less than 1 ampere or an operating voltage of not less than 100 volts.